

REMARKS

This amendment responds to the office action mailed October 6, 2003. In the office action, the Examiner:

- allowed claims 6-10, 20 and 21;
- objected to claims 15-17 for containing informalities; and
- rejected claims 11-13 and 22 under 35 U.S.C. 102(b) as anticipated by Thayer et al. (US Patent No. 5,598,119, hereinafter Thayer).

After entry of this amendment, the pending claims are: claims 6-17 and 22.

Claim Amendments

The Examiner has indicated that claims 14 and 15 are objected to as being dependent upon a rejected base claim and/or for containing informalities, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intermediate claims. Accordingly, the Applicants have rewritten claims 14 and 15 in independent form including all of the limitations of claim 11, respectively. Claim 15 has also been amended to eliminate structural details of the driver mirror current path, because claim 15 is a method claim and it is not necessary to recite such structural details. With this amendment, the Applicants believe that claims 14-17 should be allowable.

Claim 14 has been further amended by removing an extraneous word.

Claim 11 has been amended in several aspects. As amended, this claim requires a sequence of transmission switching signals for the first and second output transistors, including a first signal and a plurality of subsequent signals. The shoot-through in the output driver current path is detected in response to the first signal. The plurality of subsequent signals are modified in response to the feedback signal.

Additionally, the Applicants have corrected claims 11, 14, 15 and 20 by replacing the term “defining” with the term “improving”.

Claim Rejections - 35 U.S.C. 102

Claim 11, as amended, is directed to a method of improving performance in a push-pull driver circuit. The method is illustratively divided into two consecutive phases with the first one comprising the first three steps and the second one primarily covering the last step of claim 11. During the first phase, a first signal is applied to the push-pull driver circuit which may produce a shoot-through current in the output driver current path, and a feedback signal

is then generated in response to the shoot-through current. During the second phase, a plurality of subsequent signals are modified in response to the feedback signal.

In contrast to the Examiner's contention, Thayer does not teach a structure that is capable of detecting shoot-through current. The primary goal of the load adaptive pad driver 201 in Fig. 2 of Thayer is to provide a constant speed output at a pad irrespective of the load connected to the pad. As shown in Fig. 4A, an important issue with the conventional output driver circuit 205 is that, when the load capacitance connected to pad 203 is beyond what the output driver circuit 205 can drive, there will be a significant phase delay between the input and output signals. The load adaptive pad driver 201 solves this issue by including an auxiliary output driver that comprises two FETs, P2 and N2, which are much larger than FETs used in the output driver circuit 205. When the load capacitance is larger than the minimum for which the output driver circuit 205 is designed, it is the comparators 211 and 213 that drive their respective FETs P2 and N2 to assure that the slope of the pad 203 transition matches the slope of the reference slope generated by the respective slope generators 207 and 209. Consequently, there is no significant difference in phase delay when the load capacitance connected to pad 203 varies (see Fig. 4C).

In Thayer, the output driver circuit 205 and the auxiliary output driver operate simultaneously. Such an operation cannot be reasonably separated into two distinct phases as recited by the Applicants' claim 11. In addition, the load adaptive pad driver 201 of Thayer does not have a capability of detecting the shoot-through current. The feedback signals to comparators 211 and 213 indicate when the pad 203 voltage approaches a level that is a certain amount below V_{DD} or above the ground, e.g., 1.0 or 0.6. The comparators, in turn, decide whether it is the output driver circuit 205 or the auxiliary output driver that drives the pad 203. In other words, the feedback signals are irrelevant to the shoot-through current in the current path. The reduction of ringing is just a side effect associated with the reduction of phase delay.

From another viewpoint, detecting shoot through inherently requires monitoring at least two signals, because shoot through occurs only when two devices are both turned on. The Thayer device monitors only a single signal. Every possible value of the feedback signal in Thayer can be explained by circuit conditions that have nothing to do with shoot through. In the present invention, on the other hand, shoot through is detected. In one embodiment, shown in Fig. 9, this is done by monitoring two signals (in the mirror circuit) that are

processed by an XOR type of circuit to detect shoot through. This embodiment is discussed in detail at page 15, line 18 through page 16, line 27 of the specification.

Claim 22 recites a method of controlling shoot-through current in a push-pull driver circuit. In particular, a control signal that modifies a transmission switching signal is adjusted by the method until a shoot-through crossover is determined. This process repeats periodically by dithering the control signal in order to detect performance drift in the push-pull driver.

For the same reasons discussed above, the load adaptive pad driver 201 of Thayer does not detect the shoot-through current. Nor does Thayer teach a method of dithering the control signal to detect any kind of performance drift of the driver 201.

Since Thayer does not teach every limitation of claim 11 or 22, claims 11 and 22 as well as their respective dependent claims 12-13 are not anticipated by Thayer.

In light of the above amendments and remarks, the Applicants respectfully request that the Examiner reconsider this application with a view towards allowance. The Examiner is invited to call the undersigned attorney at (650) 849-7721, if a telephone call could help resolve any remaining items.

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Respectfully submitted;



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